



## Supplement of

## Attribution of precipitation to cyclones and fronts over Europe in a kilometer-scale regional climate simulation

Stefan Rüdisühli et al.

Correspondence to: Stefan Rüdisühli (stefan.ruedisuehli@env.ethz.ch)

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**Figure S1.** Feature frequencies of (a–d) cold fronts, (e–h) warm fronts, (i–l) cyclones, and (m–p) high-pressure areas during (left to right) winter, spring, summer, and fall 2000–2008. The outer black box shows the computational domain of the 2.2 km simulation, the inner box the analysis domain. The fields are computed by first reducing each feature in the respective time period to a binary mask field, and then averaging these binary fields to obtain the total feature frequency field.



**Figure S2.** Track frequencies of (a–d) cold fronts, (e–h) warm fronts, and (i–l) cyclones during (left to right) winter, spring, summer, and fall 2000–2008. The outer black box shows the computational domain of the 2.2 km simulation, the inner box the analysis domain. The fields are computed by first reducing each track to a binary mask field comprised of all grid points affected by any feature belonging to the track in the respective time period, and then averaging these binary fields to obtain the total track frequency field.



**Figure S3.** Frequencies of front-cyclone-relative component masks during (0) the whole year, (1) winter (DJF), (2) spring (MAM), (3) summer (JJA), and (4) fall (SON) 2000–2008. The masks are obtained at each time step by separating the domain into seven components as described in Sec. 2.5. Shown are the (a) cold-frontal, (b) warm-frontal, (c) collocated, and (d) far-frontal components.



**Figure S4.** Frequencies of front-cyclone-relative component masks as in Fig. S3, but showing the (e) cyclonic, (f) high-pressure, and (g) residual components.



**Figure S5.** Wet-hour frequency during (0) the whole year, (1) winter (DJF), (2) spring (MAM), (3) summer (JJA), and (4) fall (SON) 2000–2008, (a) overall and (b–e) for sets of front-cyclone-relative components, specifically: (b) sum of cold-frontal, warm-frontal, and collocated; (c) sum of cyclonic and far-frontal; (d) high-pressure; and (e) residual.



**Figure S6.** Like Fig. S5 b–d but for heavy precipitation, showing the frequency of hours with precipitation exceeding the local 99.9<sup>th</sup> all-hour percentile of hourly precipitation.



**Figure S7.** Relative contributions to heavy precipitation, defined as the amount exceeding the local  $99.9^{\text{th}}$  all-hour percentile of hourly precipitation intensity in a given season, during (1–4) each season of the nine-year period 2000–2008 of front-cyclone-relative components: (a) sum of cold-frontal, warm-frontal, and collocated; (b) far-frontal; (c) cyclonic; (d) high-pressure; and (e) residual.